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AN ACCOUNTING SYSTEM FOR SOLID WASTE MANAGEMENT IN SMALL COMMUNITIES.

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Environmental Protection Agency
Rockville, Maryland

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AN ACCOUNTING SYSTEM for solid waste management in small communities

Eric R. Zausner*

The increasing costs and complexities of solid waste collection and disposal require new, more sophisticated management techniques. Because data on performance and the costs of operation and ownership are essential for the use of these management tools, an adequate information system is a prerequisite to effective management. Although cost accounting represents only one part of the total information system, its design, installation, and utilization can represent a significant step in the development of effective solid waste management.

Present information on collection and disposal activities and on associated costs is both inadequate and nonstandardized. The proposed system provides a guide to the type and quantity of information to be collected, its classification, and the method of collection; it is intended to be of use to municipal or private personnel involved in the operation and ownership of solid waste management facilities.

Installation of a cost accounting system can aid the supervisor, city manager, etc., in controlling the costs and performance of the operation, and also in planning for the future.

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The system described herein is designed for small communities that collect and dispose of the solid wastes generated in their jurisdiction. These communities, with populations below 25,000, will find the system provides adequate data without a cumbersome amount of paper work. Larger communities may use the system also, although they may desire more information. Because packer-truck collection and landfill disposal is the combination most frequently encountered in small communities, the system was specifically designed to be effective for these types of operations.

System Benefits

Installing a cost accounting system has several important advantages:

1. The system facilitates orderly and efficient accumulation and transmission of all relevant data. In fact, much of the recommended data is probably being collected already, although perhaps haphazardly and inefficiently. Hence, the added cost of installing the system is minimal.
2. Reports are clear and concise and present only the data required for effective control and analysis. Because the personnel can complete and understand the reports, the system can operate in a relatively foolproof manner.
3. Standard accounting classifications and terminology are used to simplify the interpretation of results and their comparison with data from previous years or other operations. In turn, this allows analysis of relative performance and operational changes.
4. The system accounts for **all** relevant costs of operation.
5. Accumulated data from the system can over a period of time lead to standards of performance and efficiency. These standards can be used to control costs. They indicate which costs are high and the reasons. The supervisor of operations may then take appropriate corrective action.
6. The system includes automatic provisions for accountability. Cost control becomes more effective when the individual, functional activity or equipment responsible for cost increases can be ascertained.
7. Use of the collected data helps in short- and long-range forecasting of operating and capital budgets. More accurate estimation of future requirements of equipment, manpower, cash, etc., is possible; this, in turn, aids planning at all levels

of management. The data are also available for later evaluation and analysis with the use of operations research techniques.

8. With only minor modifications, the system is flexible enough to meet the varying requirements of communities with operations of different size, scope, and operational procedures.

9. Because the system is designed specifically for small communities, the number of data collection and reduction forms has been kept to a minimum to reduce paperwork.

Cost Centers and Cost Allocation

Two general types of costs are incurred by solid waste management activities: operating costs and the costs of financing and ownership. Operating costs include labor, oil and gas, parts and supplies, utilities, supervision, charges by other departments, contractual services, and other miscellaneous expenses. Labor costs include direct wages, overtime pay, and all associated fringe benefits. Included in fringe benefits are vacation pay, sick pay, group life and medical insurance, social security payments, and pension contributions. Ownership and financing costs are those associated with the loss in value of fixed assets and the costs of funds required to purchase and retain fixed assets. More commonly, the terms depreciation and interest are used.

Generally, most operational costs are expressed in the terms mentioned above. As operations become more complex, however, a more sophisticated method of accounting is required to facilitate analysis and control. To accomplish this, solid waste management activities are assumed to consist of several interrelated suboperations, each of which is analyzed separately. These suboperations are usually denoted as cost centers because costs are accumulated separately for each of them. Analysis and control are simplified if excessive costs or inefficiencies can be traced to a functional activity or area of the operation. Particularly in small communities, where operations include both collection and disposal, cost centers aid in delineating the functional areas and their associated costs.

For small communities, two cost centers, one for collection and one for disposal, appear to collect adequate information without incurring excessive accounting expenses. The Col-

lection cost center accumulates all costs associated with the collection of solid wastes on the routes themselves and with the hauling of these wastes from the routes to the disposal site or sites. The Disposal cost center accumulates all the costs associated with the actual disposal of the wastes at the landfill site.

The operating costs must be accurately and representatively allocated to the two cost centers. The allocation of costs to the cost centers and the relationship of these operating costs and the financing and ownership costs to the total annual cost has been illustrated (Diagram I). Although financing and ownership costs can be allocated to individual cost centers, the benefits do not justify the additional calculations. For general analysis and control, operating costs are sufficient for cost center analysis. At infrequent intervals, when the additional data are required (for lease-buy decisions, etc.), manual reconstruction is easily accomplished.

The method of allocation for each type of operating cost is as follows. The labor cost allocated to the two cost centers is based on the number of employees and their associated costs utilized in each cost center. Collection truck drivers and loaders have their associated costs included in the Collection cost center. Scale operators and tractor operators have their associated costs assigned to the Disposal cost center. Labor for repairs and maintenance would be assigned to the cost center that required the work. Oil and gasoline could be directly assigned to the equipment in the Collection and Disposal cost centers. Parts and supplies would be charged directly to the equipment in each cost center. Utilities would be directly assigned to the two cost centers. General overhead, which includes supervision, administration, and charges from other departments (payroll, accounting, etc.), could be allocated equally to each cost center or charged on the basis of the number of employees in each cost center.

The sum of the costs of these two cost centers is the total operating cost. The actual system is designed to facilitate the collection and later allocation of costs to these cost centers.

Reports and Information Flow

Information flows through the cost system by the use of reports, the vehicles that transmit information (Diagram II).

DIAGRAM I

ALLOCATION OF COSTS TO THE COST CENTERS AND TO THE TOTAL ANNUAL COST

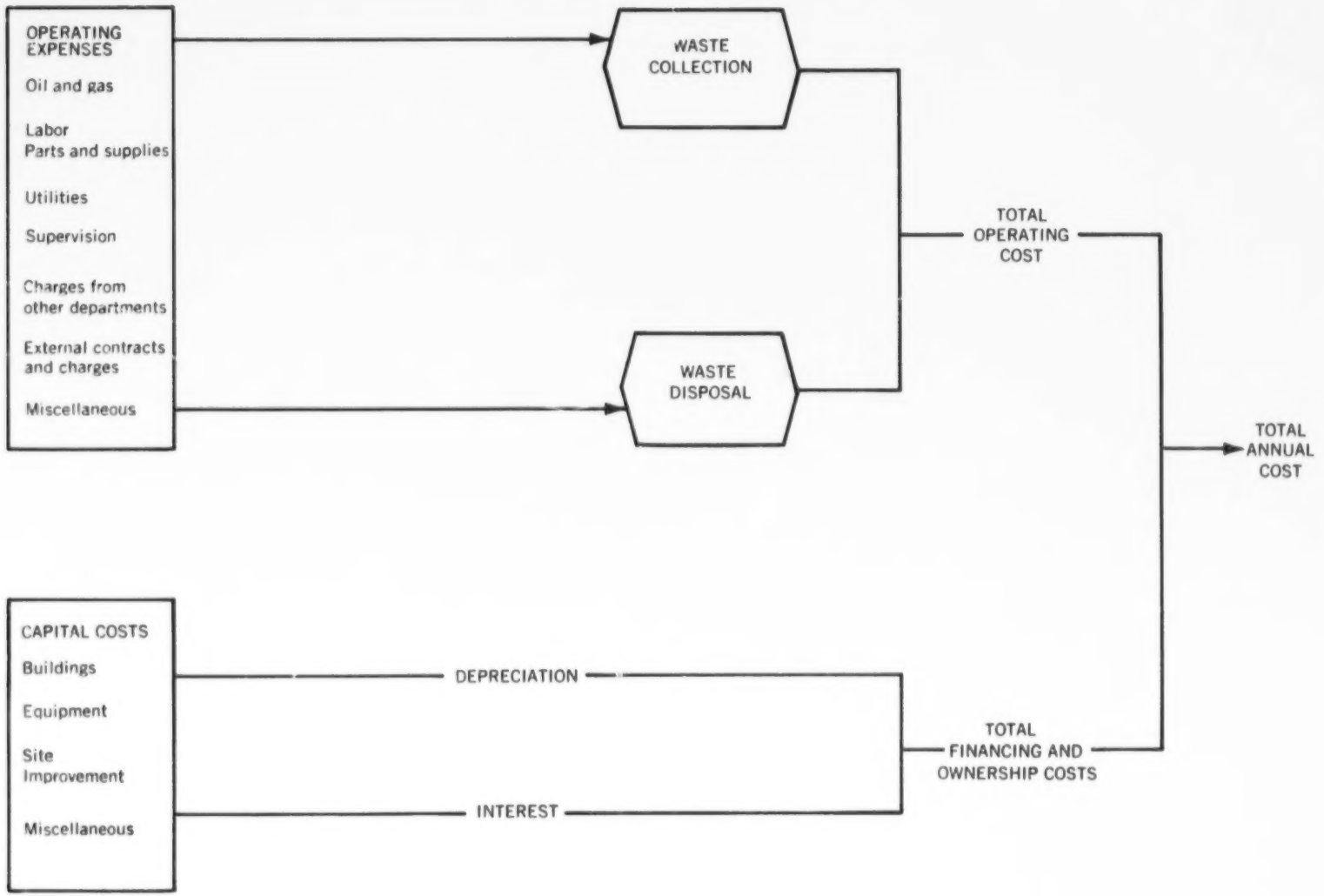
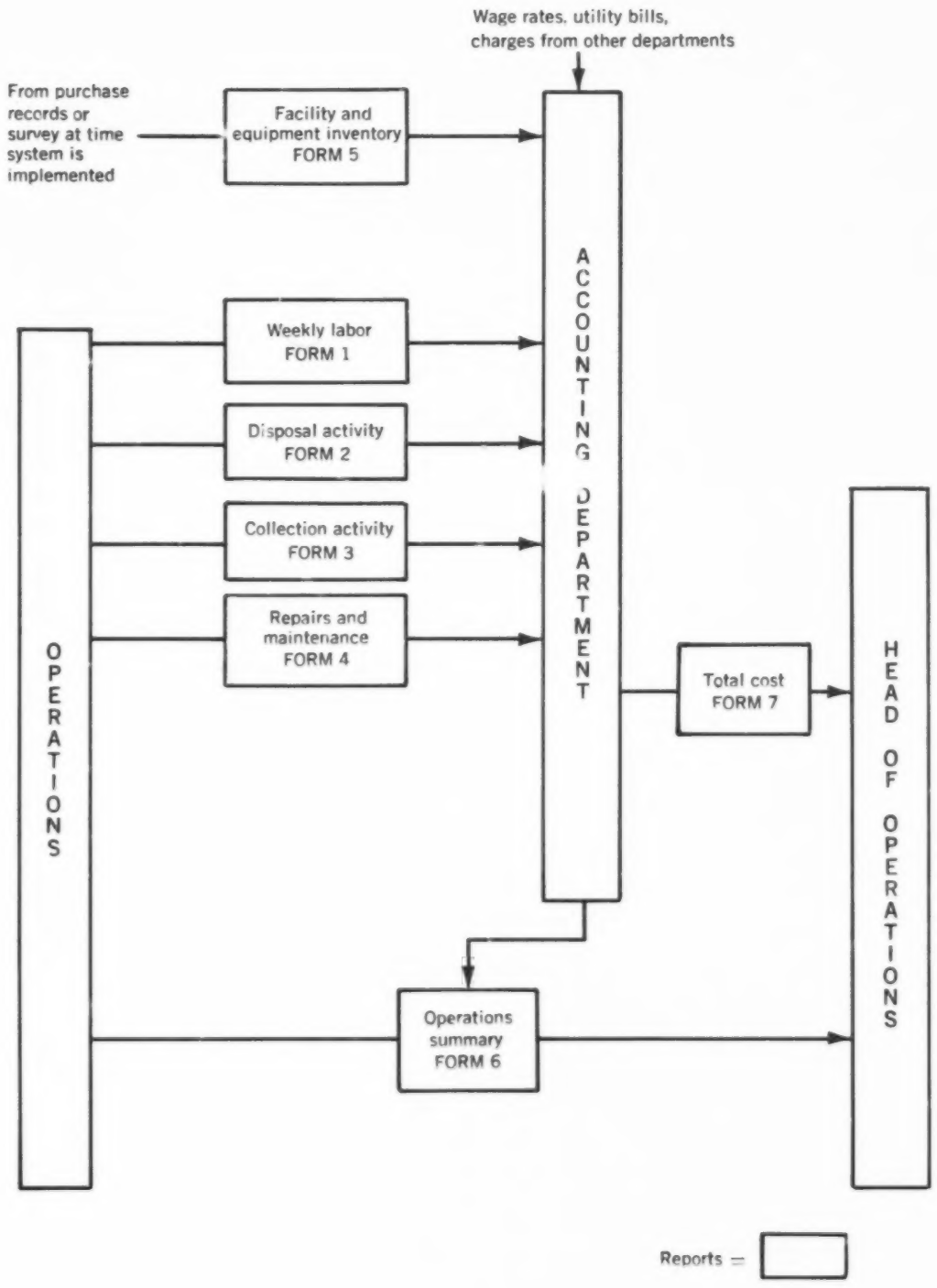


DIAGRAM II

REPORTS AND INFORMATION FLOW


Wage rates, utility bills, charges from other departments
From purchase records or survey at time system is implemented
Facility and equipment inventory FORM 5
ACCOUNTING DEPARTMENT
Weekly labor FORM 1
Disposal activity FORM 2
Collection activity FORM 3
Repairs and maintenance FORM 4
OPERATIONS
Total cost FORM 7
HEAD OF OPERATIONS
Operations summary FORM 6
Reports =

The reports can be classified as those that are primarily used to collect data and those that are used to reduce and present the data for effective management analysis and control.

Data Collection Forms

Cost analysis and control through the preparation of periodic summary reports cannot be accomplished without recording all pertinent activity and cost information. Data on activities and costs not recorded at the time they are generated are not retrievable at some later date.

Weekly Labor Record (Form 1). The foreman or supervisor records the labor activity daily. One copy is forwarded weekly to the payroll department for determining either weekly, biweekly, or monthly payroll checks. Another copy is forwarded to the accounting department or used by the supervisor for computing total labor hours and assigning these hours to the various collection and disposal activities and their related cost centers.

Daily Disposal Activity Report (Form 2). All pertinent activity at the disposal site is recorded on this form. The quantities, sources, and types of solid wastes delivered to the disposal site and the routes from which it is collected are recorded on this form. If cover material is delivered from off-site, this may also be recorded; otherwise, the column may be deleted. The information is recorded manually for the entire day. If the landfill has a scale that automatically records the weight data, that part of the form would be replaced by the printed weight ticket. Each delivery is recorded separately by the weighmaster. A second weighing of the empty truck may be taken, or the vehicle's tare weight (as determined by a licensing agency, etc.) may be substituted. If no scales are available, estimates of cubic yards can be substituted. Additional information on equipment operation is also recorded on the bottom part of the form.

Daily Collection Activity Report (Form 3). Each day the collection vehicle driver records data on the collection crew's activity and performance. Of particular importance is the check list for equipment operation. Many potential equipment failures are routinely noted; this is an invaluable aid to the foreman in scheduling equipment maintenance. The form also provides space for the data needed to determine total time servicing routes and hauling wastes to the disposal

WEEKLY LABOR RECORD

FORM 1

SITE: _____ DATE: ____/____/____

SIGNATURE: _____

Employee ident.	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Individual totals	Note causes of absences, extra hours to be paid, etc.
	Job*	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.	Job	Hrs.		
Totals	X		X		X		X		X		X		X			XXXXXXXXXXXXX

Instructions: Supervisor to complete this form daily. List all employees separately including temporary help. "Hrs." refers to hours worked daily. "Job" refers to the job description.* At the end of each week, forward one copy to the payroll department and retain the original for further use.

*TD = tractor driver (Tractor driver activity may be divided: spread and compact waste = TDS and cover operation = TDC), W = weighmaster, ME = equipment maintenance, MB = building maintenance, CD = collection truck driver, L = loader.

FORM 2

DAILY DISPOSAL ACTIVITY REPORT

SIGNATURE: _____ DATE: ___/___/___

Truck ident.	Time weighed	Waste source*	Route # collected	Weight in	Weight out (tare weight)	Amount received	
						Waste	Cover material
Totals	X	X	X	X	X		

*Sources: R = residential, I = industrial, C = commercial, etc.

LANDFILL EQUIPMENT UTILIZATION

Equip. ident.	Hours in use	Hours down	Miscellaneous expense	Remarks (note type of expense, equipment problems, and other important facts)

Instructions: To be completed on site by the scale operator. Bottom of form is only to be completed on the last sheet used each day. Form to be forwarded to the accounting department.

DAILY COLLECTION ACTIVITY REPORT

FORM 3

Time in _____ Mileage out _____

Time out _____ Mileage in _____

Date / /

Truck # _____

Crew # _____

Net time _____

Net miles _____

Gas purchased (gal) _____

Driver:

Loader:

Loader:

Remarks

Check if abnormal:

- Eng. temp. ☐
- Oil press. ☐
- Ammeter ☐
- Packer ☐
- Brakes ☐
- Lights ☐
- Other ☐

Time start	Time finish	Weight	Route #	Nonproductive time	
				Hours	Cause
Total weight					

Check if relevant and report to supervisor:

- Personal injury ☐
- Automotive accident ☐
- Property damage ☐

Instructions: The driver is to complete this form each day. "Time out" and "Mileage out" are to be completed when the truck leaves the garage in the morning. "Time in" and "Mileage in" are to be completed at the end of the day when the truck is back at the garage. When the truck reaches the first route, the time is noted in the "Time start" column and the route designation is also noted. When the truck is full or the route is left for any reason, "Time finish" is entered. Upon returning to the same route or another (after a trip to the disposal site), the next "Time start" entry is made. At the disposal site, the net weight of wastes collected is entered. Accidents, injuries, or any equipment malfunctions are to be noted in the boxes provided and a detailed explanation given in the "Remarks" box.

site, as well as the weights of waste collected. Data on accidents and injuries are also routinely noted. Important data are recorded in the left and bottom margins for easy reference and sorting. Detailed instructions for completing the form are included on the form.

Repairs and Maintenance Record (Form 4). Activities of the maintenance department and the costs incurred in maintaining each collection and landfill vehicle are recorded. One form is on file for each vehicle, and entries are made only when maintenance or repairs are undertaken. Total costs for the department as well as the costs for each piece of equipment are accumulated. The data are needed to assign the costs to the two direct cost centers and to evaluate the efficiency of individual collection and disposal equipment.

Equipment and Facility Inventory (Form 5). The data on the costs of collection and disposal equipment and the facilities (total costs as well as depreciation and interest) are recorded. The form should be completed when the accounting system is installed and updated only as new equipment is purchased, old equipment sold, or new facilities added or improvements made.

Data Reduction and Presentation Reports

Reports 6 and 7 are completed at less frequent intervals. These intervals depend on the type of information transmitted. To be effective, certain types of control and analysis require more frequent feedback than other types. These two forms reduce the data collected in the previous five forms in addition to other data available to the accounting department.

Operations Summary Report (Form 6). In this report, the collection and disposal activities and their associated operating costs are summarized. As a cost control report, routine and frequent preparation is critical; monthly intervals should be sufficient. The accounting department prepares the report and forwards copies to both the supervisor and his superior (head of the sanitation department). The report is particularly useful for cost control; total unit cost, as well as unit costs for the various cost centers, indicates where excessive costs were incurred. In addition, various measures of efficiency are presented to isolate the cause or causes of high

FORM 4

REPAIR AND MAINTENANCE RECORD

VEHICLE IDENTIFICATION _____ PERIOD: from _____ to _____

Date	Odo. mileage	Type service or repair	Hours down	Labor hours	Parts description	Labor cost	Parts cost	Outside charge	Overhead charge	Total cost
Totals		X			X					

FORM 5

EQUIPMENT AND FACILITY INVENTORY

DATE: / /

For use by accounting department only

Type	Identification No.	Capacity (cu yd)	Model No.	Model year	Manufacturer	Date of purchase	Purchase price	Estimated life	Salvage value	Percent of time*	Annual depreciation	Monthly depreciation
Total	X	X	X	X	X	X		X				

*One minus percent of time used by other departmer

FACILITY INVENTORY

	Facility	Description	Date put in use	New cost	Estimated total life	Other comments	Annual depreciation	Monthly depreciation
	Land				X		X	X
	Buildings							
	Garages							
	Roads							
	Lights							
	Fences							
	Surveys							
	Other							
	Totals	X	X		X	X		

FORM 6

OPERATIONS SUMMARY REPORT

PERIOD: from _____ to _____

	Factor	Cost or quantity for this period	% Variance from budget	% Variance from:	
				Last period	Same period last year
Totals	Total tons				
	Total operating cost				
	Total operating cost per ton				
	Labor cost per ton				
	Equipment operating cost per ton				
	Overhead cost per ton				
	Number of accidents		X		
Collection cost center	Cost per ton				
	Tons per direct labor hours				
	Equipment operating cost per ton				
	Average miles per hour				
	Tons per trip to disposal site				
	% Time equipment down				
Disposal cost center	Cost per ton				
	Cover material per wastes (tons)				
	Tons disposed per labor hour				
	Tons disposed per equipment hour				
	% Time equipment down				

operating costs. The terms are defined on Form 6a.

Total Cost and Revenue Summary (Form 7). All the activities, costs, and revenues associated with collection and disposal activities during the period are compiled on this report from the data available in the Operations Summary Report (Form 6) and the Equipment and Facility Inventory Report (Form 5). The combined operating, depreciation, and interest costs represent the total cost of solid waste management activities for the period. The accounting department can complete this form quarterly or semiannually and send it to the head of the sanitation department or his equivalent.

Report Flow Summary

The personnel directly engaged in collection and disposal activities complete data accumulation forms daily. These are transmitted periodically to the accounting department. The accounting department collates the information received and adds additional information it already possesses to complete the summary report (Form 6) on performance, activity, and costs. These forms are then fed back to the supervisor for control purposes. In addition, selected summary reports on total cost are complied and forwarded to the supervisor and his immediate superior.

System Utilization

Only with efficient and intensive utilization of the information generated from the accounting system and forms can the additional time, effort, and money required to implement and maintain the system be justified. The system's intensive use promotes two major objectives: quality control and cost control. Reduced costs must be accomplished without deteriorating operating quality. Similarly, quality is interrelated with the costs of obtaining it.

All the factors that affect the quality and effectiveness of the operations of a small community can be translated into costs. Cost control does not call for economizing at the expense of quality. On the contrary, once a level of acceptable operation has been determined along with the attendant costs, the cost control system can help the supervisor maintain that level of operation.

Effective cost control requires timely recognition of excessive costs and identification of responsibility for the increased costs. Comparing unit cost with both the current budget

OPERATING COST CLASSIFICATIONS

Labor costs

Include all wages at base pay, all overtime pay, and labor fringe benefits. Labor fringe benefits include group insurance, pension costs, social security contributions, vacation costs, etc.

Cover material costs

Include all costs for the delivery of cover material. If on-site cover material is used, exclude this category.

Equipment operating costs

Include oil, gasoline, grease, equipment repairs, and maintenance.

Overhead costs

Include all utilities, supervisor's salary, building repairs and maintenance, liability and property insurance, and charges from other departments.

FORM 7

TOTAL COST AND REVENUE SUMMARY

DISTRICT: _____ PERIOD: from _____ to _____

Data	For this period	Budget — this period	Year to date	Budget — year to date
Tons of refuse collected and disposed				
Total operating cost				
Total financing and ownership cost				
Total cost				
Total revenues*				
Net cost (profit)				
Total cost per ton				
Total revenue per ton				
Net cost (profit) per ton				

*Total revenues for collection and disposal include user charges for residential, commercial, and industrial collection as well as disposal charges that are assessed separately.

and the corresponding period last year helps indicate excessive costs. The use of unit cost facilitates the analysis of costs, independent of changes in the level of activity. The cost-center breakdowns help single out the responsible factor or person. This system allows both of these critical factors to be determined, corrective action may then be effectively initiated.

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